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FY 2004 President's Request

Climate Change Research Initiative

Carbon Cycle Atmospheric Measurements

Addresses

NOAA Mission Goal #2

Understand Climate Variability and Change to Enhance Society's Ability to Plan and Respond

What is requested?

NOAA requests an increase of $5.0M to support the implementation of a Carbon Cycle Atmospheric Observing System that focuses on North America, as part of the President's Climate Change Research Initiative (CCRI). The System will begin to define where carbon is emitted (sources) and absorbed (sinks) in and around the United States. This information will allow NOAA to predict future atmospheric concentrations of carbon in the atmosphere. The small fraction of carbon present in the atmosphere as the greenhouse gas carbon dioxide is especially important, as its abundance is a major regulator of climate. Such knowledge will help decision-makers gauge the effectiveness of future carbon dioxide emission and sequestration strategies. The program is a cooperative effort among three NOAA line offices, and contributes to the interagency U.S. Carbon Cycle Science Plan, which involves six different federal agencies.

Why do we need it?

The rapid increase in atmospheric concentrations of carbon dioxide over the past 150 years corresponds with combustion of fossil fuels since the beginning of the industrial age. Conversion of forested land to agricultural use has also redistributed carbon from plants and soils to the atmosphere. There has been growing concern in recent years that these high levels of carbon dioxide not only may lead to change in the earth's climate system, but may also alter ecological balances through effects on vegetation. Over the last 10-20 years, more than half of the carbon dioxide released by burning fossil fuels has been absorbed on land and in the oceans. The efficiency of these carbon "sinks" has been observed to change from year to year and decade to decade, due to a variety of mechanisms only partly understood. Uncertainties remain concerning how much additional carbon storage can be achieved through improved management of ecosystems and other approaches, for how long the enhanced storage could be sustained, and just how vulnerable or resilient the natural carbon cycle is to manipulation of sources and sinks. Successful carbon management strategies will need to be based on solid scientific information on the basic processes affecting the global carbon cycle.

Carbon Cycle Measurements At-a-Glance

What: $5.0 M increase

Why: Understanding the carbon cycle is essential for understanding climate change and for effective management of carbon dioxide emissions.

The U.S. Carbon Cycle Science Plan highlighted the need for research that identifies sources and sinks of carbon dioxide in North America. The Carbon Cycle Atmospheric Observing System initiative responds to this need. The program will combine field observations, modeling, and data assimilation to test and build the next generation of observational tools. These tools will be used to quantify sources and sinks at regional scales over North America and adjacent ocean basins.

Knowledge of the carbon cycle, especially biological productivity, is essential for effective natural resource management and for maintaining the long-term sustainability of ecological goods and services. Advances in carbon measurement and understanding will support products such as cutting-edge, internally consistent "maps" of carbon dioxide uptake over North America and adjacent ocean basins, routine projections of carbon sources and sinks into the future, and assessment of carbon management options.

What will we do?

In order to further define North American carbon sources and sinks, NOAA will expand a pilot program using small aircraft and tall towers to profile carbon gases. The expansion will include establishing a ring of profiling stations around the contiguous United States, adding to existing stations in the internal United States, thus completing a network of 36 atmospheric vertical profiling stations in North America. The boundary stations will allow the determination of carbon dioxide flowing onto and out of the United States, and thus provides a simple method of defining the gross source-sink characteristics of the region. At the internal stations, weekly aircraft profiling will be combined with tall tower continuous measurements to judge the significance of the sparser aircraft measurements and to provide data in support of the North American Carbon Program. In addition, the feasibility of inferring carbon dioxide amounts from current satellite instruments will be undertaken as a prelude to future satellite instrument data analyses, which will provide higher accuracy in the inference of carbon dioxide. Assimilation of carbon data into numerical weather models, which may improve forecast models, will also be studied.

What are the benefits?

The ability to pinpoint sub-regional carbon dioxide sources and sinks in the U.S. has far-reaching implications for emission information and carbon sequestration effectiveness. Determining sources of variability in North American carbon sinks will allow more effective management of US carbon emissions in the future. With input from other agencies, this program will form a foundation for routine spatial carbon "maps" and periodic "State of the Carbon Cycle" reports that will keep scientists and policy-makers abreast of progress in understanding the North American carbon cycle.

For more information:

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Climate Change Research Initiative Program Components:

- Global Ocean Observing System
- Carbon Cycle Atmospheric Observing System
- Aerosols
- Climate Change Science Program Office
- Climate Change Computing Initiative

NOAA Budget FY 2004 Change

Office of Oceanic and Atmospheric Research
Climate Observations and Services
Climate Change Research Initiative

Carbon Cycle Atmospheric Measurements
$5.0M